PRIMARY INFESTATION OF SPROUTING CHESTNUT, RED, AND WHITE OAK ACORNS BY *VALENTINIA GLANDULELLA* (LEPIDOPTERA: BLASTOBASIDAE)[1]

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ABSTRACT: Larvae of the acorn-infesting moth *Valentinia glandulella* usually are found in acorns damaged by rodents or other insects. However, data from field studies in Ohio indicate that female moths oviposit on, and larvae can develop in, sound sprouting acorns. Impact of the moths on seedling establishment was not significant.

Larvae of the moth *Valentinia glandulella* (Riley) are considered secondary insect pests in oak acorns. Murtfeldt (1894) described some of the habits of the "acorn moth," which was originally called *Blastobasis glandulella* by Riley (1872). She called the moth an "inquiline" that followed primary acorn invaders. Gibson (1972) described the larvae of this moth as scavengers in white oak, *Quercus alba* L., acorns and as a secondary invader of northern red oak, *Quercus rubra* L., acorns (Gibson 1982).

In the fall of 1984, while conducting studies on techniques to assess insect impact on acorn viability and seedling establishment, I found that *V. glandulella* larvae were primary invaders of sprouting white oak acorns. Further studies in the spring and fall of 1985 revealed a heavy infestation of sprouting red and chestnut oak acorns by larvae of this insect.

METHODS

The white oak and chestnut oak acorn studies were conducted in a 20-year old, mowed but uncultivated nursery at the Delaware, Ohio laboratory within two rows of chestnut oak, *Q. prinus* L., about 60 m long and 9 m wide. The oaks were in their fourth year of bearing acorns; a heavy crop of acorns was produced in 1985, previous crops were light. The two rows of chestnut oak were bordered on the east by pine trees and on the west by white oaks which bore no acorns. The north and south ends of the nursery were open fields.

The red oak acorn study was conducted in the Wayne National Forest, Hocking County, Ohio, a hilly, upland region characteristic of millions of hectares in the eastern United States. The forest type of the region is

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classified as oak-hickory; several oak species contribute 50 to 95 percent of the merchantable trees in the stands. Average stand age is 50+ years. Linear study plots were established in 10 areas on sites ranging from poor, dry ridgetops to good sites on low slopes on the north face. Chestnut oak and scarlet oak, *Q. coccinea* Muenchh., dominated the upland, dry sites, while red oak was common on good sites. White oak and black oak, *Q. velutina* Lam., dominated the medium sites.

Acorns of red and white oak were collected in late September and October near the Forestry Sciences Laboratory at Delaware, Ohio. The acorns were placed in plastic bags and stored at 5 ± 2°C until used. All acorns used in this study had begun to sprout while in cold storage. The acorns were examined carefully before deployment in the field; acorns that showed signs of prior or current insect activity were discarded. A piece of hardware cloth (6-mm mesh) 5 cm square was cut in the shape of an equal-arm cross. An acorn with a sprout 1 to 10 mm long was placed in the center of the cross and the arms of the cross were folded over the acorn. The caged acorn was placed on the soil or on an oak leaf, and a 37.5-cm-long flag wire was inserted through the wire mesh and pushed about 7 to 10 cm into the ground. The cage and wire combination prevented rodents from carrying away the acorns but allowed insect access to the nuts.

Twenty caged white oak acorns were placed in the nursery within the rows of chestnut oaks on October 16 and were removed on October 25. A second group of 20 acorns was exposed from October 20 to November 13. The acorns were examined for insect feeding damage and then placed in jars to rear out the insects.

On March 13, 1985, 152 red oak acorns with sprouts 1 to 10 mm long were caged and deployed with flag wires as described for the southern Ohio plots. Four linear plots, one for each cardinal direction, were established in 50- to 80-year-old-oak stands. The caged acorns were spaced 2 m apart along a line descending from the ridge top.

On March 27, 130 additional caged red oak acorns were deployed on 3 plots in a different area. These acorns were linearally spaced 2 m apart on a ridgetop, near the bottom and along the contour of a southwest face and along the midslope contour of a south-facing hill.

On April 3, 203 more caged red acorns were deployed on 3 additional plots in another location. The plots were established along a ridgetop and along the contour of a northfacing midslope and a south-facing midslope. On May 8 the acorns were collected from all the plots, brought to the laboratory, placed on moist paper towels in rearing containers, and checked daily for insect emergence.

On October 28, 301 sprouting chestnut oak acorns were picked up in the chestnut oak planting at Delaware, Ohio and inspected for insect

damage. Ninety-five acorns showing *V. glandulella* frass where the acorn radicle emerged but had no other signs of insect damage, were selected for planting. Seventy-five acorns with no apparent insect damage were planted for comparison. The acorns were placed individually in 20 ounce (591 ml) styrofoam cups on top of a 50/50 mixture of sand and peat moss. One hundred ml of distilled water was added to each cup and the cups covered with small glass plates. The glass plates were removed when the seedling shoots appeared. The cups were held at 24 ± 2°C in a laboratory on a 16 hour day. Lighting was provided by ceiling fluorescent lights. On December 4, a tally was made of the number of seedling oaks. Acorns not producing seedlings were cut open and examined.

RESULTS

Seven *V. glandulella* larvae were reared from the 20 white oak acorns exposed from October 16 to October 25. Three more were reared from the acorns exposed from October 25 to November 13. Eight adult moths were reared from the 10 larvae by the end of December.

Two hundred and eighty-six *V. glandulella* larvae, 13 adults, and 1 hymenopterous parasite were reared from 467 red oak acorns (18 of the original acorns were lost to vandalism). More than 150 adult moths and 3 hymenopterous parasites were reared from the larvae, which were placed on a moist sand/vermiculite mixture for pupation.

In addition to the *V. glandulella* larvae from red oak, more than 3,000 nitidulid larvae, tentatively identified as *Stelidota* sp., were collected. This nitidulid is being investigated as a primary pest of sprouting acorns. Also collected were 84 larvae of the weevil *Conotrachelus posticatus* Boheman and 3 elaterid larvae.

Only 2 red oak seedlings were established from the original 485 acorns deployed. The actual impact of *V. glandulella* on seedling establishment could not be determined because of dual infestation of the acorns, in most cases by the nitidulids.

Infestation of red oak acorns by *V. glandulella* occurred equally on all sites with the exception of a windblown west slope, which produced only 3 larvae from 31 acorns. One hundred and thirty larvae and adult moths were reared from the 130 acorns deployed on March 27. Since only 1 larva usually develops per acorn, the rate of infestation for this date probably was near 100 percent. The heavy infestation of some acorns by nitidulids made it impossible to determine if all the acorns produced *V. glandulella*. Eighty-four larvae and 1 adult moth were reared from the acorns deployed on March 13, 78 larvae and 5 adults were reared from the acorns deployed on April 3.

One hundred and forty-one (46%) of the 301 chestnut oaks acorns collected on October 28 were ultimately found to be infested solely by *V. glandulella*. This infestation rate, however, could have been affected because most of the chestnut oak acorns in the nursery had been collected in early October for other research purposes.

Thirty of the planted "insect-free" acorns were later found to be infested with *V. glandulella* and moved to the "infested" group. One hundred and eleven seedlings were produced from the 125 *V. glandulella* infested acorns. Thirteen acorns rooted but produced no top shoot. Only one acorn was destroyed by a *V. glandulella* larva which severed the radicle. Forty-one seedlings were produced from the 45 insect-free acorns. Four acorns in this group rooted but failed to produce tops.

Several *V. glandulella* infested acorns which produced seedlings were cut open and examined to determine the extent of damage. The examination revealed that although extensive feeding damage can occur, usually on the outer surfaces of the cotyledons, the larvae do not feed on the hypocotyl which links the developing radicle to the food reserves in the cotyledons.

In conclusion, *V. glandulella* is a primary invader of sprouting acorns but the only damage seems to be in reducing the amount of nutrients available for full seedling development. The only significant impact from this moth on oak regeneration might be the attraction of nitidulids to *V. glandulella* infested acorns. Current laboratory studies indicate that nitidulids can destroy germinating acorns and preliminary studies show that the nitidulids show a preference for *V. glandulella* infested acorns. This may explain the extensive damage to the red oak acorns in Southern Ohio.

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